

Amendments to the Drawings:

Attached is a complete set of replacement drawings for originally filed sheets 1 through 8, plus four new drawings sheets numbered as sheets 9 through 12. The attached sheets 1-12 can be used to completely replace the original sheets 1-8.

The notation "PRIOR ART" has been added to Figures 2-5 in the new drawing sheets. Also, Figure 2 has been changed to add reference numeral "12" thereto.

Attachments: Replacement sheets 1-8 and new sheets 9-12

Annotated sheets showing changes

Remarks

This Amendment is in response to the Office Action mailed February 15, 2007. Claims 26 and 27 are newly added. Claims 6, 7, 9, and 24 have been amended. No new matter has been added to the Application. Claims 1-5, 8, 10-13, 15-23, and 25 have been cancelled. Claims 6, 7, 9, 14, 24, 26, and 27 will be pending in this Application upon entry of this Amendment.

The Office asserted that the Information Disclosure Statements filed December 18, 2003 and November 17, 2005 failed to comply with 37 C.F.R. 1.98(a)(2), by not including a legible copy of each cited foreign patent document and each non-patent literature publication. A copy of both the Greiner et al. and Abd-Elmoniem non-patent citations are included with an Information Disclosure Statement enclosed with this Amendment. Payment for the filing of a late Information Disclosure Statement accompanies the included Information Disclosure Statement. It is respectfully requested that the documents in the accompanying Information Disclosure Statement be considered and made of record in this Application.

The objection to the drawings under 37 C.F.R. 1.83(a) as failing to show the speckle reduction filter as described in the specification is respectfully traversed.

Applicants disagree with the Office's assertion that no speckle reduction filter is shown in the figures. For example, several embodiments of speckle reduction filter are recited in paragraph [0028] and which are described as mathematical algorithms executed by one or more CPUs 112 and 114 shown in Figure 6. In addition, paragraph [0027] references memory 116, which stores programs executed by CPUs 112 and 114. CPUs 112 and 114 and memory 116 are included in SCDC 16 of Figure 1. It is therefore submitted that Figures 1 and 6 show the structural details necessary to understanding of these embodiments of the present invention.

For the above reasons, the objection to the drawings under 37 C.F.R. 1.83(a) as failing to show the speckle reduction filter as described in the specification should be withdrawn.

The objection to Figures 1-5 for not being designated as "prior art" is respectfully traversed.

As indicated above with respect to the objection to the drawings under 37 C.F.R. 1.83(a), the structural details of Applicants' invention are shown, at least in part, by Figure 1 and Figure 6. It would therefore be misleading and confusing to one of ordinary skill in the art to label Figure 1 as "prior art." Thus, it is respectfully requested that this objection be withdrawn from Figure 1.

Replacement Figures 2-5 have been designated as "prior art," as required by the Office.

For the above reasons, the objection to Figures 1-5 for not being designated as "prior art" should be withdrawn.

Figure 2 has been amended to include the reference numeral for beamformer 12. Accordingly, this objection should be withdrawn.

The further objection to the drawings under 37 C.F.R. 1.83(a) is respectfully traversed.

The method steps of Claims 5, 8, and 10-13 need not be added to the drawings because these Claims have been cancelled. The method steps of Claims 6, 7, 9, and 14 have been added in new Figures 12, 13, 14, and 15, respectively. These new Figures add no new matter to the Application as they are supported by Claims 6, 7, 9, and 14 of the originally filed Application and by the originally filed specification, as indicated in the discussions of Claims 6, 7, 9, and 14 below. Paragraphs [0018.1] and [0042.1] through [0042.4] have been added to describe these new Figures. Paragraphs [0018.1] and [0042.1] through [0042.4] likewise add no new matter to the Application as they are also supported by the same portions of the specification as originally filed as are the new drawings.

No new figures need be added to further illustrate the claimed configuration of the ultrasound imaging system of Claims 21-23 and 25, as these claims have been cancelled. In addition, no new figures are required to illustrate the claimed configuration of Claim 24, inasmuch as the transducer array is illustrated by numeral 34, the beamformer by numeral 12 and a portion of Figure 2, the processor for processing a receive beam from the beamformer by 14, and the scan converter and display controller by 16. The configuration of the processor, the scan

converter and display controller can be realized in software stored in memory 116 and executed by CPUs 112 and 114, as shown in Figure 6 and described at Paragraph [0027]. Therefore, it is submitted that the object to the drawings concerning the illustration of the imaging system of Claims 21-25 should be withdrawn.

The objection to the Abstract of the Disclosure is respectfully transversed. The grammatical correction suggested by the Office has been incorporated into the Abstract, so this objection should be withdrawn.

The objections to the disclosure for various informalities is respectfully traversed.

The changes suggested by the Office to overcome the objection to Paragraph [0021], [0022], [0023], [0024], and [0031] have been made.

In Paragraph [0028], reference to an embodiment in which a speckle reduction filter is implemented between the detector and the SCDC has been deleted. Therefore, this objection no longer applies to Paragraph [0028].

For the above reasons, the objections to the disclosure for various informalities should be withdrawn.

The rejection of Claim 24 under 35 U.S.C. 112, first paragraph, for lack of enablement, is respectfully traversed.

The Office asserted that Claim 24 recites a single processor that simultaneously processes data subsets and that one of ordinary skill in the art would be unable to perform simultaneous processing with one processor.

Applicants respectfully disagree. Claim 24 recites, "An ultrasound imaging system in accordance with claim 21 wherein the scan converter and display controller includes a central processing unit (CPU) that simultaneously processes the data subsets of the image data stream." CPUs and processors capable of simultaneously processing data subsets of image data streams were known at the time the present invention was conceived. See, for example, T.M. Le, W.M. Snelgrove, and S. Panchanathan, "SIMD processor arrays for image and video processing: a review," In S. Panchanathan, F. Sijstermans, and S.I. Sudharsanan, editors, Multimedia

Hardware Architectures 1998, volume 3311 of SPIE Proceedings, pages 30--41, 1998, <http://citeseer.ist.psu.edu/le98simd.html>, which is attached in an Information Disclosure Statement attached herewith, along with bibliographic information. Support for the use of SIMD processors in the present invention is found in the specification at Paragraph [0031] as originally filed. It is further submitted that the amendment to Paragraph [0031] defining the terminology SIMD does not add new matter to the specification, as the term SIMD was known in the art, as shown by the title of Le, Snelgrove, and Panchanathan article, and that one of ordinary skill in the art would understand from the context provided by Paragraph [0031] that the term SIMD as used therein refers to "Single Instruction-Stream, Multiple Data-Stream."

For these reasons, it is submitted that the rejection of Claim 24 under 35 U.S.C. 112, first paragraph, should be withdrawn.

The rejection of Claims 15-19 under 35 U.S.C. 101 is respectfully traversed.

Claims 15-19 have been cancelled, thus, the rejection of Claims 15-19 under U.S.C. 101 should be withdrawn.

The rejection of Claims 1, 2, 9, and 11 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek et al. (U.S. Pat. No. 5,619,998) in view of Kamath et al. (U.S. Pat. No. 6,879,729) is respectfully traversed.

This rejection no longer applies to Claims 1, 2, and 11, which have been cancelled.

Assuming, *arguendo*, that Abdel-Malek discloses receiving a processed data stream from a processor, dividing the processed data stream into data subsets, filtering the data subsets by using a speckle reduction filter to produce filtered data subsets, and producing an image stream based on the filtered data subsets. Further, assuming, *arguendo*, that Kamath discloses dividing the processed data stream into data subsets and simultaneously filtering the data subsets.

Abdel-Malek discloses that the thresholding factors may be either automatic or manual control. See col. 6, lines 20-41. In the automatic control method, processor 40 of Fig. 2

implements a nonlinear function of each scale (level of resolution) that compares each output signal over a user-defined sample length to determine the minimum of a set of maximum values of the absolute value (or the square) of the signal within a window. However, nowhere does Abdel-Malek teach or suggest “optimizing the parameters based on an application.”

By contrast, Applicants’ Claim 9, as herein amended, recites, “... the filtering step is based on adjustable parameters, the method further comprising: automatically, without user intervention, optimizing the parameters based on an application and a scan of an imaging system.” See paragraph [0032] of the Application as originally filed, where it is disclosed that “the method may refer to a mapping table that provides various sets of parameters of the speckle reduction filter based on the application and the scan modes. In the example, an image of a liver is filled with more speckle noises than speckle noises in vascular images. Therefore, in the example, the mapping table maps to parameters providing greater smoothness than the amount of smoothness provided to vascular images.” As indicated above, Abdel-Malek teaches providing a nonlinear function implemented in a processor, not optimizing the parameters based on an application as described in paragraph [0032] and claimed in Claim 9.

It is submitted that Claim 9 is patentable over Abdel-Malek et al. in view of Kamath et al.

For the above reasons, the rejection of Claims 1, 2, 9, and 11 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek et al. in view of Kamath et al. should be withdrawn.

The rejection of Claim 3 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Hatfield et al. (U.S. Pat. No. 5,954,653) is respectfully traversed.

This rejection no longer applies because Claim 3 has been cancelled. Therefore, the rejection of Claim 3 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Hatfield et al. should be withdrawn.

The rejection of Claims 4, 6-8, 10, and 13 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath, and further in view of Weisman et al. (U.S. Pat. No. 6,674,879) is respectfully traversed.

This rejection no longer applies to Claims 4, 8, 10, and 13, which have been cancelled.

The Office has admitted that Abdel-Malek and Kamath do not disclose simultaneously co-displaying a filtered image and an original unfiltered image on a common screen, wherein the filtered image is generated from the image data stream and the original unfiltered image is generated from the processed data stream.

The Office referred to Figures 5 and 7 of Weisman, as well as col. 13, lines 2-4 to assert that Weisman discloses “changing values of the parameters between the first and second value sets to form a simultaneously co-displaying a first image and a second image on a common screen, wherein the first image is generated from the first image data stream, and wherein the second image is generated from the second image data stream.” However, Figure 5, as described in Weisman at col. 3, lines 52-56, illustrates a quad display of a captured echocardiogram raw data image, the speckle reduced image, the edge detected image, and the color quantization of the movement of the image during the heart cycle along with a patient information screen. Similarly, Figure 7, as described in Weisman at col. 3, lines 60-64, illustrates a quad display of a raw image, a speckle reduced image, an edge detected image, and the color quantization of the movement of the image during the heart cycle along with the abnormalities identified based on the measurement data. Thus, neither Figure 5 nor Figure 7 teaches or suggests displaying a first image and a second image, which are speckle-reduced images using parameters of a first value set and parameters of a second value set, respectively, nor does the more detailed description of these Figures at col. 14, lines 29-67. Also, Weisman states, at col. 13, lines 2-4, that the physician may then choose one of several processing combinations from menus. The default is for processing average images with moderate speckle. There is no teaching or suggestion of displaying a first image and a second image, which are speckle-reduced images using parameters of a first value set and parameters of a second value set, respectively.

By contrast, Applicants’ Claim 6 recites, “... simultaneously co-displaying a first image and a second image on a common screen, wherein the first image is generated from the first image data stream, and wherein the second image is generated from the second image data stream, and further wherein the first image and the second image are speckle-reduced images using parameters of the first value set and parameters of the second value set, respectively.” See

Paragraph [0035]. It is therefore submitted that Claim 6 is patentable over Abdel-Malek and Kamath, and further in view of Weisman et al.

With respect to Claim 7, the Office referred to col. 6, lines 54-67 to assert that Weisman discloses simultaneously co-displaying, in a dual display mode, a filtered image and an original unfiltered image on a common screen, wherein the filtered and the original unfiltered image are reconstructed from a data set that includes the image data stream and the processed data stream; and enabling a user to enter the dual display mode during one of a scan, a replay of pre-recorded cine loops, and a display of a still image that is not updated periodically. However, Col. 6, lines 54-67 merely teach that frames are transferred from a host memory to a display driver for display on a display monitor, and further teach how a cine display can be performed. There is no teaching or suggestion of enabling a user to enter the dual display mode at least one of during a scan, while a replay of pre-recorded cine loops is displayed on a screen, and while a still image that is not updated periodically is displayed on the screen.

By contrast, Applicants' Claim 7 recites "... simultaneously co-displaying, in a dual display mode, a filtered image and an original unfiltered image on a common screen, wherein the filtered and the original unfiltered images are reconstructed from a data set that includes the image data stream and the processed data stream; and enabling a user to enter the dual display mode at least one of during a scan, while a replay of pre-recorded cine loops is displayed on a screen, and while a still image that is not updated periodically is displayed on the screen." See paragraph [0040]. For these reasons, it is submitted that Claim 7 is patentable over Abdel-Malek and Kamath, and further in view of Weisman et al.

For the above reasons, the rejection of Claims 4, 6-8, 10, and 13 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath, and further in view of Weisman et al. should be withdrawn.

The rejection of Claim 5 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Muzilla et al. (U.S. Pat. No. 5,908,391) is respectfully traversed.

Claim 5 has been cancelled, so this rejection no longer applies.

For the above reason, the rejection of Claim 5 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Muzilla et al. should be withdrawn.

The rejection of Claim 12 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Li (U.S. Pat. No. 6,517,486) is respectfully traversed.

Claim 12 has been cancelled, so this rejection no longer applies.

For the above reason, the rejection of Claim 12 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Li should be withdrawn.

The rejection of Claim 14 under 35 U.S.C. 103(a) as being unpatentable over Grunwald et al. (U.S. Pat. App. No. 10/081,542) in view of Abdel-Malek and further in view of Kamath is respectfully traversed.

The Office's assertions rely upon Grunwald to show a beamformer 110, frequency compounding beams to obtain a filtered image data stream 732, producing a second image data stream 834 and/or 932 based on the filtered data stream (or filtered modes 1026 and 1120), and simultaneously co-displaying a filtered image and a second image on a common screen, wherein the filtered image is generated from the filtered image data stream and the second image is generated from the second image data stream (image areas 3504 and 3508), the "screen can be tiled to view two image areas simultaneously," so when one image is frequency compounded, and another is filtered, the compounded and filtered images can be viewed at the same time.

However, referring to Figs. 6-11 and paragraphs [0033] to [0039] of Grunwald, it is clear that Figs. 7-11 represent separate modes of operation of the ultrasound system, not data streams. See also paragraphs [0103] to [0119] for a description of various modes shown in Fig. 6 and the description of Figs. 7-11 starting at paragraph [0120]. Numeral 732 refers to a image compounding mode in the B-mode of ultrasound system 100, as described at paragraphs [0121] and [0131], rather than a data stream, and numerals 834 and 932 refer to a flash suppression mode of a color flow mode of ultrasound system 100 (see paragraph [0134]) and to a flash suppression mode of a power Doppler mode of ultrasound system 100 (see paragraph [0138]), respectively. Thus, modes 834 or 932 do not represent a second image data stream based on

mode 732, which is also not a data stream. A similar observation can be made of filter modes 1026 and 1120. Therefore, Grunwald does not teach or suggest producing a second image data stream based on filtered data.

By contrast, Applicants' Claim 14, as herein amended, recites, "... frequency compounding the beams to obtain a filtered image data stream; ... producing a second image data stream based on the filtered data subsets; and simultaneously co-displaying a filtered image and a second image on a common screen, wherein the filtered image is generated from the filtered image data stream and the second image is generated from the second image data stream." See, for example, paragraph [0034] of the Application as originally filed by Applicants. Therefore, it is submitted that Claim 14 is patentable over Grunwald et al. in view of Abdel-Malek and further in view of Kamath

For the above reasons, the rejection of Claim 14 under 35 U.S.C. 103(a) as being unpatentable over Grunwald et al. in view of Abdel-Malek and further in view of Kamath should be withdrawn.

The rejection of Claims 15-16 under 35 U.S.C. 103(a) as being unpatentable over AbdelMalek in view of Kamath is respectfully traversed.

Claims 15 and 16 have been cancelled, so this rejection no longer applies.

For the above reason, the rejection of Claims 15-16 under 35 U.S.C. 103(a) as being unpatentable over AbdelMalek in view of Kamath should be withdrawn.

The rejection of Claim 17 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Hatfield is respectfully traversed.

Claim 17 has been cancelled, so this rejection no longer applies.

For the above reason, the rejection of Claim 17 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Hatfield should be withdrawn.

The rejection of Claim 18 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Weisman is respectfully traversed.

Claim 18 has been cancelled, so this rejection no longer applies.

For the above reason, the rejection of Claim 18 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Weisman should be withdrawn.

The rejection of Claim 19 as being unpatentable over Abdel-Malek and Kamath and further in view of Muzilla is respectfully traversed.

Claim 19 has been cancelled, so this rejection no longer applies.

For the above reason, the rejection of Claim 19 as being unpatentable over Abdel-Malek and Kamath and further in view of Muzilla should be withdrawn.

The rejection of Claim 20 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek in view of Kamath is respectfully traversed.

Claim 20 has been cancelled, so this rejection no longer applies.

For the above reason, the rejection of Claim 20 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek in view of Kamath should be withdrawn.

The rejection of Claims 21 and 23-24 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek in view of Kamath is respectfully traversed.

This rejection no longer applies to Claims 21 and 23, which have been cancelled.

With respect to Claim 24 as herein amended, although Kamath may show a device that includes more than one CPU, wherein each CPU simultaneously processes a data subset of the image data stream, as asserted by the Office, Kamath does not show a scan converter and display controller that include a central processing unit (CPU) with Single Instruction-Stream, Multiple Data-Stream (SIMD) capability that simultaneously processes the data subsets of the image data stream.

By contrast, Applicants' Claim 24 recites, "... the scan converter and display controller include a central processing unit (CPU) with Single Instruction-Stream, Multiple Data-Stream (SIMD) capability that simultaneously processes the data subsets of the image data stream." See paragraph [0031]. Thus, it is submitted that Claim 24 is patentable over Abdel-Malek in view of Kamath.

For the above reason, the rejection of Claims 21 and 23-24 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek in view of Kamath should be withdrawn.

The rejection of Claim 22 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Weisman is respectfully traversed.

Claim 22 has been cancelled, so this rejection no longer applies.

For the above reason, the rejection of Claim 22 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Weisman should be withdrawn.

The rejection of Claim 25 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Grunwald is respectfully traversed.

Claim 25 has been cancelled, so this rejection no longer applies.

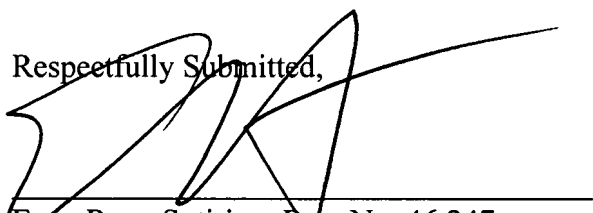
For the above reasons, the rejection of Claim 25 under 35 U.S.C. 103(a) as being unpatentable over Abdel-Malek and Kamath and further in view of Grunwald should be withdrawn.

Claim 26 is new. This claim incorporates the Office's comments regarding Claims 15-19. Furthermore, Claim 26 is patentable over the prior art at least for the same reasons given above with respect to Claim 6, inasmuch as the method that the processor is caused to perform mirrors the method of Claim 6.

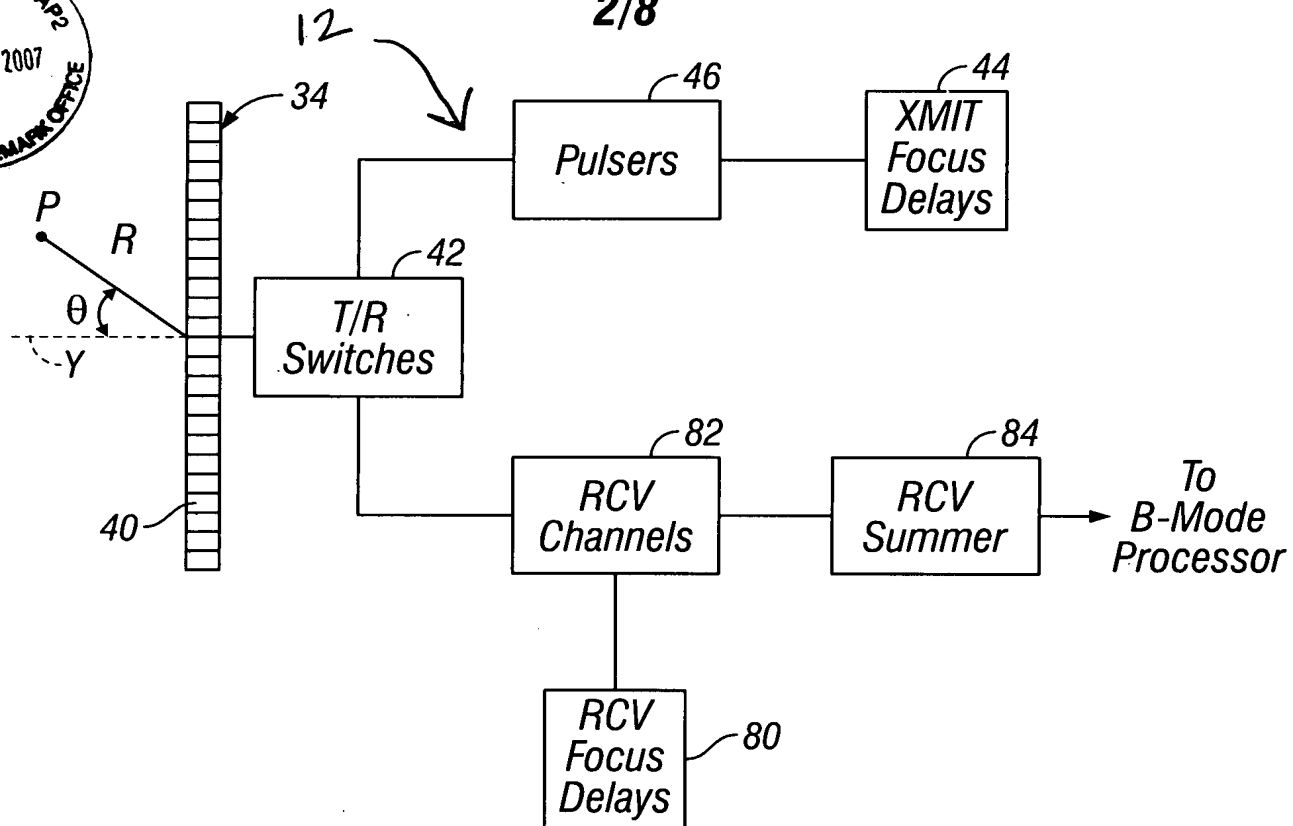
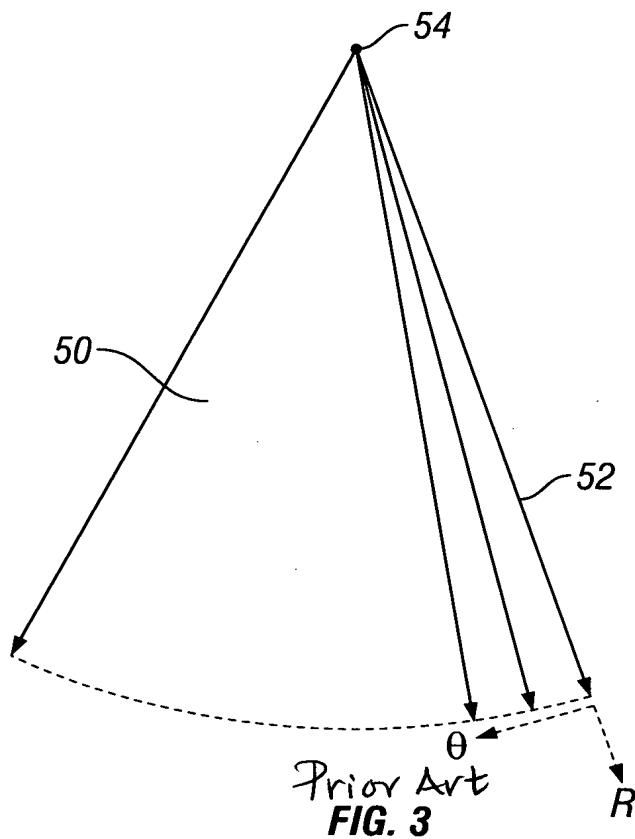
Claim 27 is also new. This claim is patentable over the prior art for at least the same reasons given above with respect to Claim 6, inasmuch as the claim is directed to an ultrasound imaging system configured to perform the method recited by Claim 6.

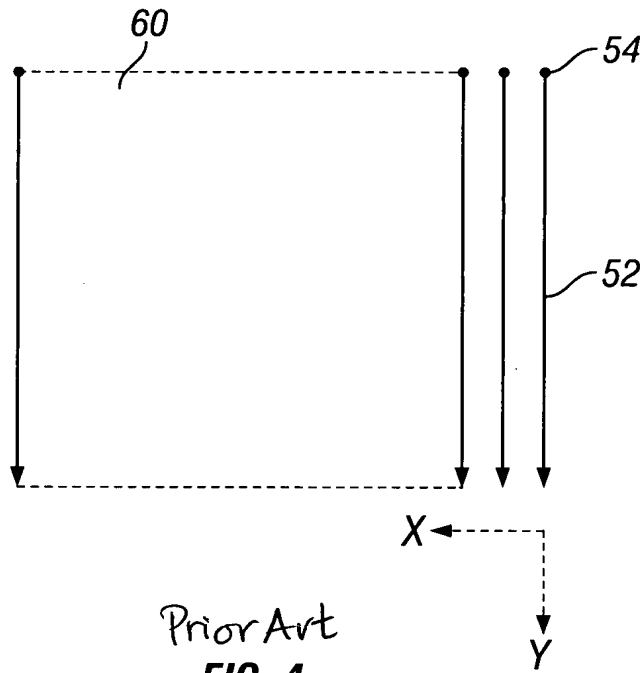
In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully Submitted,

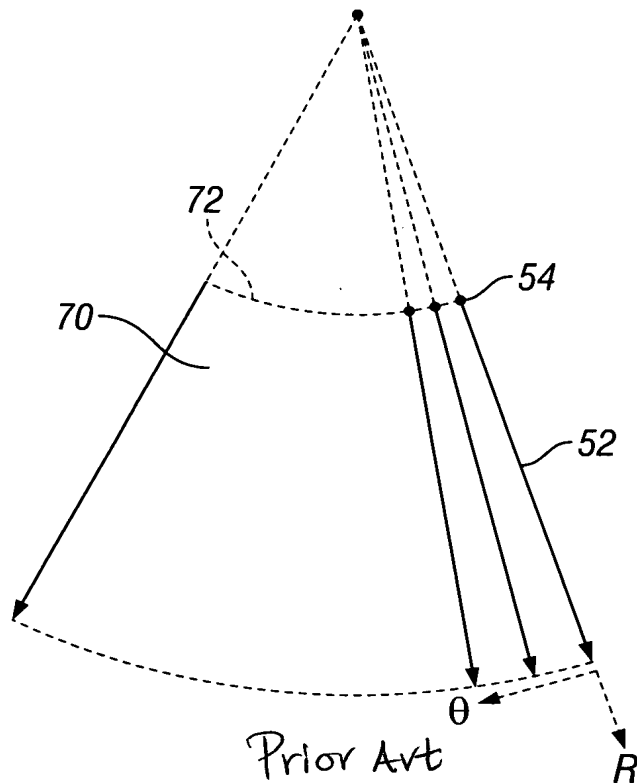


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**FIG. 2** Prior Art**FIG. 3** Prior Art



Prior Art
FIG. 4



Prior Art
FIG. 5